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(54) IMPROVEMENTS IN OR RELATING TO HAND GRIPS FOR MANUAL IMPLEMENTS

(71) We, WILLIAM J. SPARKS, of 5120 Granada Boulevard, Coral Gables, Florida, United States of America and CHARLES E. SPARKS of 102 Evans Lane, Cherry Hill, New Jersey, United States of America, both citizens of the United States of America do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to hand grips for the handle portions of manual or hand operated and hand powered implements. More particularly, this invention relates to such a grip in which the outermost layer thereof is a foamed cellular elastomer. An especially preferred application of the grip is for a golf club.

Hand powered and hand operated implements are often controlled by direct manual contact with an operating shaft. The hand powered area of the shaft is very often a portion of the shaft itself. For many purposes the manual control area of the shaft is covered by a superimposed layer of a different composition. The contact layer may be serrated, roughened, drilled, wrapped or perforated to provide friction so as to avoid slippage. In the alternative, the shaft may be separated from the hand by a non-adhering insulating layer positioned between the hand and shaft, thus acting like a glove. The use of such devices is important in order to improve precision, to prevent slippage, shifting or turning, and to reduce shock at the time of impact. Of course, this must be done with a minimum of energy loss and with a maximum of energy transfer through the shaft to the manipulated object.

The material of the superimposed layer attached to the shaft has been widely varied. All of the compositions used heretofore, however, have one common property. They are relatively hard. Hardness is commonly expressed in durometer hardness units, such as Shore hardness. Shore A hardness is determined with the Shore A durometer in which a probe is forced into the test specimen. A reading from 0 to 100 units reflects the hardness, the higher readings indicating harder compounds, as set forth in the ASTM Standards on Rubber Products D2240—68. The hardness may also be expressed in International Hardness units, as defined in ASTM 1970 Part 28, Book of Standards, Part 28, D1415—68. Any hardness instrument capable of giving a comparable reading may be used. A metal or wood composition, resin impregnated cloth, or hard rubber would all have a Shore A durometer hardness in the range of 75 to 100. Mass rubber compositions vary from Shore A durometer hardness of almost 100 down to about 65. The usual leather products are in the same range.

We have discovered that foamed sponge elastomers, and particularly sponge elastomers that have certain physical properties within a carefully selected range, are highly desirable materials for forming the grip covering the shaft of a hand operated and hand powered implement.

Cellular rubber is a general term covering all cellular materials that have an elastomer as the polymer base. Expanded rubber describes those cellular rubbers produced by expanding bulk rubber stocks and may be open-celled, closed-celled or a mixture of the two. The grips to be manufactured by this invention are made from essentially closed-cell rubber. They are prepared by expanding a fluid polymer base to a low apparent density cellular state and then preserving this state. Chemical blowing is brought about by incorporating a chemical agent into the base material which agent on heating liberates a gas causing foaming of the base material. The chemical agent is referred to as a "blowing agent".

The cellular elastomer compositions especially useful in the invention have a Shore A durometer hardness in the range from 20 to 50. This degree of hardness may be

defined more fundamentally as capable of noticeable deformation at the pressure of the grip at impact with an object. During such operation the muscles of the upper extremities cause the carpal, metacarpal, and phalanges bones of the wrist and fingers to apply force through the soft tissues and skin causing a deformity of the compressible cellular elastomer at the point of the applied force. This deformity of the sponge elastomer prevents slippage and loss of force.

Thickness of the elastomer is also important. In order to obtain the advantages of grip non-slippage and low hand abrasion, the thickness should exceed 0.5 millimeter. In order to minimize gripping zone hysteresis, the thickness should not greatly exceed 25 millimeters. The preferred thickness will vary according to the particular use, as will be more fully explained below.

Another limitation in the use of the softer materials is a loss in certain needed physical properties when the apparent density of the cellular elastomer is too low. When the apparent density of the cellular elastomer is below about 16% of that of the original stock, the composition looses abrasion resistance and wear resistance to an undesirable degree. The upper range of apparent density should be less than about 95% in order to provide the desired feel. The term "apparent density" is used to mean the density of the cellular elastomer which is measured, as distinguished from the real density of the elastomer before blowing. The lower apparent density results from the substantially uniform generation of gas throughout the structure during or as a part of a vulcanization operation. The blown cellular elastomer is a vulcanized article having an apparent density less than the density of the original unvulcanized compound. As a rough measure applicable to all elastomers the apparent density of the cellular elastomer may be defined as between 16% and 95% of the density of the unvulcanized stock.

In summary, the cellular elastomer used for this invention will have a Shore A durometer hardness in the range from 20 to 50, a thickness from 0.5 mm to 25 mm and an apparent density within the range of 16% to 95% of the density of the unvulcanized elastomer stock. The novel grip results in greater precision, less energy loss, and reduced shock at the time of impact. It also reduces injury to the hand.

The grip is useful for hand operated and hand powered implements whenever it is desirable that a hand grip be securely grasped and held. It is essentially useful for implements which are used to transmit the power through a shaft to a head that is used to strike an object, when the impact of the ball or other object is with sufficient force that it may cause blisters or callouses on the hand. The grips are used in various sports and games such as field hockey, ice hockey, lacrosse and squash; and also in raquets for tennis, table tennis and the like and for fishing poles. Other uses include hand instruments such as spades, rakes, shovels, wrenches and brooms, or for a policeman's billy club. Herein the discussion for illustrative purposes will be with reference to grips for golf clubs. However, it will be understood that the grips of this invention find application in many fields.

When a ball is hit with a golf club, due to the shape of the club head, the ball is struck at a point offset from the handle or shaft axis. This results in an undesirable twisting of the club in the hand, regardless of the type of hand grip that is on the shaft of the club. If the outermost surface of the grip next to the hand is harder than the hand, the players hand will be injured whenever the hard surface of the club grip twists in the hand, and callouses will form. Using clubs with the grips now on the market even the best golf professionals have thick callouses on their hand where they have grasped the club. The ordinary player will come home from an occasional game with sore hands; the arthritic golfer may not be able to play at all due to the shock at his finger joints. We have provided a grip where the surface grasped by the hand has approximately the same hardness as the hand itself. Morover, the grip can be tailored to the hardness of the hands of a particular player. Abrasion will not occur between two surfaces having approximately the same hardness and cushioning effect. Thus, any twisting of the club due to an off-center blow will abrade, not the hand, but the interface between the soft grip and the steel shaft. Thus, the golfer will not lose the "feel" so important to all professional golfers. If the grip wears out, it is disposable and easily replaced with another one.

In one embodiment of this invention the grips for golf clubs and similar structures having recurring patterns are made by extrusion or molding processes to a predetermined design comprising a pair, or multiple pairs of grip structures, as will be more fully described below.

It is an advantage of this invention that it is unnecessary in many instances to remove a conventional hard grip already in place on the shaft of a golf club in cases where one desires to equip a club with the improved grip of this invention, since the cellular elastomer grip can be made to expand and fit over the grip already in place, and adhere to it due to elastomeric tension. This the cellular elastomer grip can be used not only to replace the grip customarily used on the golf club, but can be used as an outermost sheath or sleeve for a grip which is already present on the shaft. In a preferred embodiment the overlay of cellular elastomer has essentially

the same composition as the solid elastomer underneath to which it adheres.

For a replacement grip the thickness of the wall of the tubing will generally be thicker than when it is used merely as an overlay or as an additional protective grip as the outermost layer. The thickness of the overlay is usually less by an amount sufficient to compensate for the thickness of the grip which is being covered.

The cellular grip may extend completely over the length of the hand area, or may cover only a portion of the length thereof. Thus the shaft may be jacketed only intermediate the shaft length, or in the case of a putter, for a longer length reaching near the club head. Also the grip may be positioned only on the part normally held with one hand, thus making it unnecessary to wear a glove on that hand to ensure a tight grip on the club without slippage during play. Then a grip of harder material such as solid unfoamed elastomer or leather is positioned over the part of the shaft held with the other hand. There is an advantage of having a different type of grip material for each hand since, in a right handed person, the left hand which holds the club serves a different function than the right hand which guides the club. There is a tendency to let the left thumb slide down the grip at the top of the swing which changes the hand position causing the shot to be missed. With the cellular grip of this invention, the left thumb is unable to slip, thus resulting in an improved game.

A fuller understanding of the invention may be had by referring to the following description, taken in conjunction with the accompanying drawing in which:—

Figure 1 is a perspective view of a conventional golf club in which the invention may be incorporated.

Figure 2 is a cross-sectional view of the shaft of a golf club and illustrates the invention being incorporated therein.

Figure 3 is a perspective view of a double grip pair.

Figure 4 is a perspective view of extruded pairs of grip structures which are programmed to a predetermined design.

Figure 5 is a cross-sectional view of a cap suitable for holding the grip of a golf club in place.

Figure 6 is a cross-sectional view illustrating another form of holding cap.

As shown in Figure 1 a conventional golf club has a head for hitting the ball. The head is connected to a shaft 1 which is generally a hollow tube or a solid rod with a slight downward taper from the top of the shaft to the neck of the head. A hand grip encircles the shaft 1 at the uppermost portion of the shaft for a distance of from about 10 to 13 inches for conventional clubs, and sometimes for a longer distance, especially in special types of putters. The grip may be molded at the top of the shaft so as to close the end, or the top may be protected by cap 3.

In Figure 2 the shaft 1 of a golf club is enveloped with a jacket or grip 2. Alternatively, the upper end of the grip may be folded over the top of the shaft as shown in Figure 5 and held in place by a cap 7.

Figure 3 shows a pair of grips in mirror image design which may be molded together in one piece, or extruded as in Figure 4 and then cut in sections to meet the needs of the individual user.

Figure 4 illustrates a series of recurring units of programmed pairs of grips extruded in predetermined dimensions of thickness and length which are designed to be tapered from the center towards each end. Preferably these grips are cut in pairs as in Figure 3.

Figure 5 is a cross-sectional view of a cap 7 suitable for holding the grip of a golf club in place when the end of the grip is folded over the end of the shaft. The top may have any desired shape such as flat, rounded, cupped, and the like. The sides may have substantially the same thickness throughout, or the lower rim of the sides may be thickened for causing greater compression in the elastomer grip so as to result in a firmer hold on the shaft.

The cap 8 of Figure 6 has a plurality of tines 13 projecting downwardly between grip 2 and shaft 1. Both the cap of Figure 6, and cap 3 which is located at the top of the shaft in Figure 2, are useful for holding a grip which is cut, for example, at x′—x′ or x″—x″ Figure 3.

The grips of this invention may be made in integral double grip units, wherein each grip of a single unit is tapered from the center toward the end to include within its length all degrees of length and thickness. Thus, a section of the double grip can be cut to meet the requirements of a particular individual.

This grip is made in at least double grip sections either by extrusion and air cure; or by molding and curing in the mold. Each half section corresponds to one grip. The two half-sections are mirror images and are deliberately made longer and larger toward the center than that of the grip usually sold. Thus in mounting the grips the operator cuts to his predetermined length and top section diameter. By this method, it is possible to satisfy the varying length and size requirements of every individual golfer using one two-grip section.

Extrusion is a classical method of forming soft rubber products. Even when cellular rubber is processed by molding and pressure curing, the mold blanks are generally made by extruding. The extrusion of tubular products having recurring structure may be programmed so that the final form is produced

according to a prearranged schedule. This process has been found to be especially useful in making grips such as those for golf clubs, fishing poles, and the like, where the grip is tapered and of varying thickness throughout its length. One example is illustrated in Figure 4. This linear programming followed by continuous curing is especially attractive. Dimensions may be maintained during extrusion by slight internal gas pressure. However, the extrusion designed uncured product can be set by vulcanizing in a steam chamber, or even by molding. In the latter case, the shape and internal stability of the object is maintained by insertion of a mandril or a rod through the hole of the cylindrical object. The grip may be preset and cut to desired dimensions of length, and thickness prior to vulcanization. This is general practice. However, the tubing is preferably cut in such a way as to produce at least two recurring units in each finally vulcanized product, as illustrated in Figure 3.

Although most experience has been with cellular elastomer mirror image, recurring structure, dual golf grips, the processes and products are applicable to all grip structures having recurring patterns capable of programmed extrusions. This is true even though in some cases it may be preferred to mold a single double grip structure which may be cut with varying distances from the center and from the ends to produce two personalized grips having preselcted size, shape, and length characteristics.

The programming of an extruder can be brought about in any suitable manner, as is known in the art. For example, the extruder orifice is programmed so as to open or close in greater or lesser degree as the tubing is formed to duplicate a series of tubular structures shown in Figure 4. This programming is brought about by operating from a control governer in much the same way as a key is cut from a blank, using a master key as a guide.

When individual grips are cut as sections from recurring double grip pairs as shown in Figure 4, the installation of the grip may require the use of a cap at the top end of the grip and a cup at the lower end of the grip to hold the grip in place on the club. Suitable caps for this purpose are illustrated in Figures 2, 5 and 6. The grips may be anchored at the lower end by any suitable means such as tape, plastic cups, or by winding with thread, as is well known in the art.

When the individual grips are molded from a cellular elastomer with a soft rubber grip having a Shore hardness in the range from 20 to 50, preferably the cap is made of a harder material which has greater wear resistance. This can be accomplished in several ways. For example, a cap made of harder material may be positioned in the mold prior to foaming of the soft rubber portion; or the cap may be molded from a solid elastomer placed in the mold at the same time. The unfoamed elastomer cap may be of the same material as the grip, or a different material may be used. The cap portion need not be made of an elastomer, but can be a dissimilar substance, such as a plastic. The Shore hardness of the cap is preferably in the range of from 45 to 90.

Most elastomers can be made into closed-celled materials. Natural rubber, styrene-butadiene rubber, nitrile rubber, vinyl polymers, polychloroproprene (Neoprene), chlorosulfonated polyethylene butyl rubbers, polyurethane elastomers, silicone rubbers and some polyacrylates have been successfully used.

To obtain a cellular elastomer, a decomposable blowing agent, along with vulcanizing systems and other additives are compounded with the uncured elastomer at a temperature below the decomposition temperature of the blowing agent. When the uncured elastomer is heated in a forming mold it undergoes a viscosity change. The blowing agent and vulcanizing systems are chosen to obtain cellular rubber of different qualities. The current cellular rubbers are made almost entirely with decomposable blowing agents. The various types of such decomposable blowing agents used are exemplified by the following: sodium bicarbonate, 2,2′ - azobisisobutyronitrile, azodicarbonamide, 4,4′ - oxybis(benzenesulfonhydrazide), and dinitrosopentamethylenetetramine. Each of these blowing agents is typical of a class of compounds which is useful for expanding cellular rubber, and was chosen because it is an important commercial compound in its particular class. Other useful blowing agents include biuret, urea, dimethylsiloxane, p,p′ - oxybis(benzenesulfonyl hydrazide), 1,3 - diphenyltriazene, azo - dicarbonamide, 4,4′ - diphenyldisulfonyl azide and N,N′ - dimethyl - N,N′ - dinitrosoterephthalamide; inorganic compounds include ammonium bicarbonate, ammonium carbonate, sodium bicarbonate, and the like.

The timing for blowing-agent decomposition must occur soon enough after the point of lowest viscosity for the elastomer being used to cause expansion of the elastomer, but far enough past this point to allow the cell walls to become strong enough not to rupture under the blowing stress.

The production of a grip having the optimum hardness and "feel" after curing to the optimum physical properties for stability and wear resistance requires the initial selection of a rubber stock which, before blowing, has a hardness outside the range of maximum manual sensitivity, tactile rugosity and "feel". It is thus unexpected relationship between the nature of the non-aerated vulcanized stock and mechanically softened grip structure which makes it possible to produce useful

grips for hand operated equipment having optimum tactile rugosity, manual sensitivity and "feel". In spite of the number of tests developed to characterize the compression of flexible cellular polymers used for cushioning, a major consideration in the selection of materials for a particular purpose is left to the "feel" of experts in the field.

Expressed in hardness which is a useful common denominator for all of these properties, it is necessary to use a rubber stock which when vulcanized to an approximate optimum has a hardness of 45 to 75 Shore and which with incorporation of a blowing agent or its mechanical equivalent produces a Shore A hardness in the range from 20 to 50. At the same time it is possible to over-sponge a harder rubber to a low but unsatisfactory softness by using a great excess of blowing agent. The amount of the blowing agent will be within the range from 1% to 5% by weight of the total formulation. If the material is too hard, one will obtain a "hard foam" when vulcanized.

The expansion of closed-celled rubber to make the grips is often carried out in two steps. The initial step is a partial cure and is carried out by pre-forming the grip as a cylinder, and using an extruder. The stock may ordinarily be extruded at a temperature high enough to produce some curing and expansion. The tubular material can then be cut to size and placed in a mold of exactly the desired size and shape. The mold is then heated more thoroughly to complete the expansion and cure. In the alternative, the grip may be pre-formed as a sheet and the sheet rolled around the mandrel which is placed in the mold.

A continuous extrusion process may also be utilised. In this case a more rapid rate of cure is necessary in order to ensure the cure of the elastomer before the cellular structure collapses.

The preferred elastomer for this invention will have a closed cell structure. The following formulation is representative:

Example

	Parts by Weight
First Pass	
Neoprene W	50
Neoprene WHV	25
Neoprene WB	25
Maglite D	2
Octamide (Registered Trade Mark)	2
MT Black	35
FEF Black	15
Circosol ® 4240	20
Heliozone	3
Stearic Acid	1
Second Pass	
Univel MD (azide blowing agent)	1.5
Activator DN	0.5
Zinc Oxide	5
Diethyl Thiourea	2
NA-22	2

Extruder	Die, Head	140°F
	Barrel	120°F
	Screw	100°F
Oven	Ist Zone	350°F
	2nd Zone	400°F
	Speed	2 ft/min.
Die	(o.d. control)	0.350 inches
Pin	(i.d. control	0.312 inches

The extrusion and oven curing processes are largely a matter of laboratory convenience.

The carbon black may be substituted for other pigments to obtain whatever color is desired. In such formulations basic materials, especially tetiary amines, act as catalysta and accelerate the reaction, whereas acidic materials tend to retard it. The uniformity of size of the cells are affected by the addition of surface active agents. Usually nonionic or cationic surfactants are employed. Fillers and plasticizers are also added in many cases to give specific properties to the foam.

In a preferred embodiment of this invention the outermost surface of the grip is a foamed cellular elastomer which has a multiplicity of very small holes or micropores open on the outermost surface of the hand-grip contact area, so as to produce a "feel" due to an inherent vacuum or suction effect upon squeezing the grip with the hand.

An intensive study of hand grips in the range of manual sensitivity and in the range of Shore A hardness from 20 to 50 has led to the independent observation that the range of maximum sensitivity and of preferred hardness is also in the range of the elastomer properties which produces a useful vacuum effect.

It is well known that when a cup, bulb or other shaped object made of resilient material is deformed in such a manner as to reduce its volume with the escape of air, and then is permitted to expand to a larger volume without the entrance of air, a vacuum effect or suction will be produced, the amount vary-

ing with the amount of change of volume. The effectiveness of this operation depends on the resilience or hardness of the material which permits the deformation resulting in the change of volume. When the material is had very slight or no noticeable deformation takes place; whereas, when the material is softer, sufficient deformation readily takes place so as to give a vacuum or suction type of effect. This mechanical principle has proved useful in numerous applications for example, in the common household plunger which is useful for opening clogged kitchen sinks.

When grips are molded from a vulcanized blown elastomer, the surface next to the mold has a smooth "mold finish" even when made from a closed cell sponge rubber. Heat expands and converts the stock into a spongy mass having a large number of small cells therein. The gas does not escape from the mold, but where it strikes walls of the mold sections, it forms a skin. When the stock is fully cured the skin may be smooth, or the surface of the expanded stock may have small depressions or pockets so that the grip will have a pitted surface which has a soft feel when grasped in a person's hand. The grip will then not be likely to slip as the pits serve as vacuum cups and create an inherent suction effect resisting the sliding of the grip through the hands of a person holding the shaft to which the improved grip has been applied.

Although cellular rubber is an improvement over mass rubber in sweat, oil and rain resistance, the smooth finish on molding is undesirable in a hand powered grip because the presence of a smooth finish tends to promote slippage of the grip in the hand while in use. Opening the cells in the smooth surface will result in reducing the Shore hardness and a better feel. Thus opening the cells in a grip having a Shore hardness of 40—55 which is too hard in tactile rugosity, feel and range of maximum hand sensitivity, but which otherwise has good properties, will operate to reduce the hardness which may be below 40 at the outermost surface hand contact.

The smooth surface comprising the mold finish of the grip formed during manufacture by contact with the mold and cover plate, or by air, will be durable, rigid and solid. The regular texture is important in that the implement is more readily and firmly gripped when the surface texture is uniform. The grip may be made of foamed material which is substantially closed cell, but partially open cell, the aforesaid preferred density recited being that which is resistant to mechanical damage.

When soft rubber grip is a sponge elastomer having essentially a closed cell structure, the multiplicity of small open holes are formed by opening or exposing the cells already present at the outermost surface. This can be done by mechanical means, for example, by abrading, grinding, sanding, scraping, filing, sawing from a block of cellular rubber, using a wire brush, and the like. Preferably these operations are carried out with the grip not under tension. Otherwise the finish may be less uniform.

The open cells at the surface can also be produced at the time the grip is being formed in a mold. For example, by using an excess of lubricant and then suddenly releasing the mold very rapidly, at an elevated temperature, some of the surface cells will explose at the outermost surface to produce a relatively uniform exposed cellular surface.

The number and size of the holes on the outermost surface of the elastomer will vary with the manner in which they are made. Generally, the very small holes will be less than 1/32 inch in diameter and positioned at random. Preferably, the number of these small holes will be at least 100 per square inch of surface, but may be even thousands per square inch, depending on the method of preparation.

The cellular grip which is made by opening the cells on the surface of sponge elastomer grips at the hand contact surface is to be distinguished from grips occasionally found made of hard rubber in which avoidance of slippage is brought about by making indentations or perforations at the surface. Indentations are closed at the bottom, but are comparatively much larger in size. Perforations in the outside layer are open at the bottom and cylindrical (not spherical) in shape. Moreover, in order to maintain strength of the material the number of perforations, is limited, for example, to less than ten per square inch.

The grips will have holes with a maximum depth corresponding to the average diameter of the cells, and an average depth corresponding to the radius of the cells. There will be at least hundreds and usually thousands of open cells per square inch.

When one squeezes the grip with the hand, the total volume on the outermost surface of the grip is reduced by the rugosity relationship of the hand and the surface, which on relaxing the muscles of the hand, creates a very gentle inherent suction effect, tending to hold the hand in place and reducing slippage. This cannot happen if the rubber is sufficiently hard that it will not be deformed by the hand under the normal hand pressure at the time of use, or if the rubber is so soft as to have no elastic recovery. The amount of the vacuum effect can, of course, be regulated by regulating the size and number of the holes present.

WHAT WE CLAIM IS:—

1. A manual implement wherein a hand grip for the implement comprises a jacket surrounding a handle portion of the im-

plement, said jacket comprising a layer of a foamed cellular vulcanized elastomer having a Shore A durometer hardness from 20 to 50, a thickness from 0.5 mm to 25 mm, and an apparent density from 16% to 95% of the real density of an unfoamed elastomer of essentially the same composition.

2. An implement as claimed in claim 1, wherein said elastomer is a filler modified synthetic elastomer.

3. An implement as claimed in claim 1, wherein said elastomer is a filler modified natural rubber.

4. An implement as claimed in claim 1, 2 or 3, wherein the outermost surface of the jacket has a multiplicity of very small holes open at said surface and closed at the bottom so as to produce an inherent vacuum type of effect upon squeezing said grip with the hand.

5. An implement as claimed in any one of the preceding claims, wherein said jacket is positioned only on that part of said handle portion which is normally held with one hand, and a hand grip of a harder material surrounds a part of said handle portion normally held with the other hand.

6. An implement as claimed in any one of the preceding claims, wherein said jacket is superimposed upon a harder grip material surrounding the handle portion.

7. An implement as claimed in any one of the preceding claims, which is a club.

8. An implement as claimed in claim 7, which is a golf club.

9. An implement as claimed in any one of the preceding claims 1 to 6, which is a racquet used in sports and games.

10. An implement as claimed in any one of the preceding claims 1 to 6, which is a hand tool.

11. An implement as claimed in any one of the preceding claims 1 to 6, which is a fishing pole.

12. A manual implement having a hand grip constructed substantially as hereinbefore described with reference to Fig. 2, 5 or 6 of the accompanying drawings.

13. A hand grip for a manual implement comprising a jacket for surrounding a handle portion of the implement, said jacket comprising a foamed vulcanised elastomer having a Shore A durometer hardness in the range from 20 to 50, a thickness from 0.5 mm to 25 mm, and an apparent density from 16% to 95% of the real density of an unfoamed elastomer of essentially the same composition.

14. A grip as claimed in claim 13, wherein the outermost surface of the jacket has a multiplicity of very small holes open at said surface and closed at the bottom so as to produce an inherent vacuum type of effect upon squeezing said grip with the hand.

15. A dual grip structure comprising two integral grips as claimed in claim 13 or 14 disposed in axial alignment, the outside dimensions of said grips being tapered from the center towards each end, or from both ends towards the center.

16. An integral extruded structure containing recurring units of said dual grip structure claimed in claim 15.

17. A hand grip or grip structure constructed substantially as hereinbefore described with reference to any one of Figs. 2 to 6 of the accompanying drawings.

18. A method of making a hand grip for a manual implement which comprises the steps of selecting an elastomer composition which will vulcanize at approximate optimum cure without a blowing agent to give a Shore A hardness from 45 to 75, adding to said formation from 1% to 5% by weight of a blowing agent, and expanding and curing to form a grip having a Shore A hardness from 20 to 50.

19. A method as claimed in claim 18, wherein said grip is cured to have a substantially closed cell structure, a thickness from 5 mm to 25 mm, and an apparent density within the range from 16% to 95% of the density of the unvulcanized elastomer stock.

20. A method as claimed in claim 18 or 19, including the steps of making one or more pairs of a tubular dual grip structure of the elastomer composition which is thicker and wider at the center and thinner and narrower at both ends in outside diameter, or *visa versa*, by linear programming followed by continuous curing, and then cutting the structure into individual grips.

21. A method as claimed in claim 18, 19 or 20, including the steps of producing a multiplicity of very small holes open at the outermost surface of the grip(s) with the result that a useful inherent vacuum or suction type of effect is produced upon squeezing said grip(s) with the hand.

22. A method as claimed in claim 21, wherein said grip(s) is made by removing the mold finish of a cellular elastomer grip so as to expose the underlying surface cells.

23. A method as claimed in claim 21, wherein a relatively uniform exposed cellular surface is produced during a molding

process by using an excess of mold lubricant and then releasing the mold pressure very rapidly at an elevated temperature so as to explode at least some of the cells at the outermost surface.

24. A method of making a hand grip for a manual implement substantially as hereinbefore described with reference to any one of Figs. 2 to 6 of the accompanying drawings.

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1356971 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

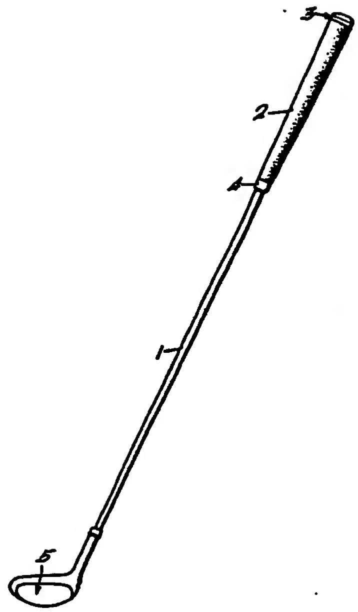

Fig.1

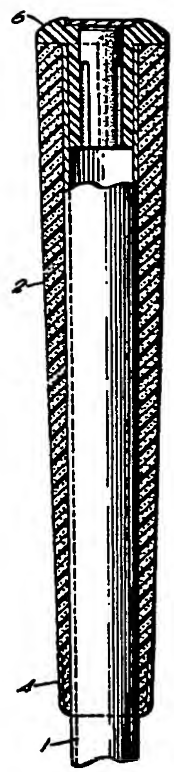

Fig.2

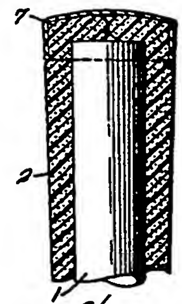

Fig.5

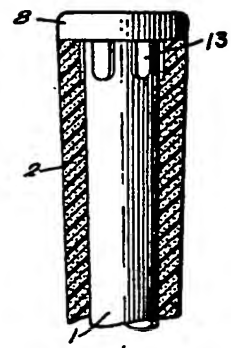

Fig.6

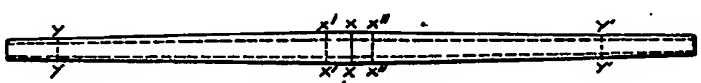

Fig.3

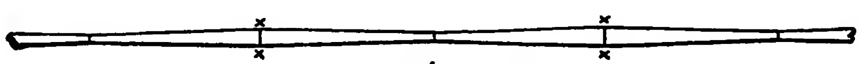

Fig.4